# Volume Contents


**LETTER TO THE EDITOR**

Publish and Perish? The Rules of the Game. *Ann M. Hirsch and Stefan J. Kirchanski* 1131

**VIEWPOINTS**

Specialized Zones of Development in Roots. *Hideo Ishikawa and Michael L. Evans* 725

**UPDATE ON ROOTS**

How Do Real Roots Work? Some New Views of Root Structure. *Margaret McCully* 1

**UPDATE ON ROOT BIOLOGY**

Root Architecture and Plant Productivity. *Jonathan Lynch* 7

**UPDATE ON BIOTECHNOLOGY**

Plant Antibodies for Immunotherapy. *Julian K.-C. Ma and Mich B. Hein* 341

**UPDATE ON PLANT DEFENSE PROTEINS**

Lectins as Plant Defense Proteins. *Willy J. Peumans and Els J. M. Van Damme* 347

**UPDATE ON SIGNAL TRANSDUCTION**

Signal Transduction in Leaf Movement. *Gary G. Coté* 729

Annexins of Plant Cells. *Greg B. Clark and Stanley J. Roux* 1133

**UPDATE ON SALT STRESS**

Ion Homeostasis in NaCl Stress Environments. *Xiaomu Niu, Ray A. Bressan, Paul M. Hasegawa, and José M. Pardo* 735

**UPDATE ON ENVIRONMENTAL STRESS**

Phytochelatins and Related Peptides. Structure, Biosynthesis, and Function. *Wilfried E. Rauser* 1141

**RAPID COMMUNICATION**

Evidence That Plant $K^+$ Channel Proteins Have Two Different Types of Subunits. *Huixian Tang, Aurea C. Vasconcelos, and Gerald A. Berkowitz* 327

Effects of Mercuric Chloride on the Hydraulic Conductivity of Tomato Root Systems. Evidence for a Channel-Mediated Water Pathway. *Albino Maggio and Robert J. Joly* 331

Expression of an Arabidopsis Potassium Channel Gene in Guard Cells. *Robert L. Nakamura, William L. McKendree, Jr., Rebecca E. Hirsch, John C. Sedbrook, Richard F. Gaber, and Michael R. Sussman* 371

Tryptophan Decarboxylase, Tryptamine, and Reproduction of the Whitefly. *John C. Thomas, Deanna G. Adams, Craig L. Nessler, Judith K. Brown, and Hans J. Bohnert* 717

Morphometric Analysis of Rice Seed Protein Bodies. Implication for a Significant Contribution of Prolamine to the Total Protein Content of Rice Endosperm. *Hari B. Krishnan and Jerry A. White* 1491

**BIOCHEMISTRY AND ENZYMOLOGY**

Purification and Characterization of a Novel Aminopeptidase, Plastidial Alanine-Aminopeptidase, from the Cotyledons of Etiolated Sugar Beet Seedlings. *Abdelhak El Amrani, Claude Suire, Bilal Camara, Jean-Pierre Gaudillère, and Ivan Couée* 87

Induction of Hexose-Phosphate Translocator Activity in Spinach Chloroplasts. *W. Paul Quick, Renate Scheibe, and H. Ekkehard Neuhaus* 113

A Cytochrome P-450 Monooxygenase Catalyzes the First Step in the Conversion of Tabersonine to Vindoline in *Catharanthus roseus*. *Benoit St-Pierre and Vincenzo De Luca* 131

Cell-Free Synthesis of Pectin. Identification and Partial Characterization of Polygalacturonate 4-α-Galacturonosyltransferase and Its Products from Membrane Preparations of Tobacco Cell-Suspension Cultures. *Ron Lou Doong, Karen Liljebjelke, Gregory Fralish, Ashim Kumar, and Debra Mohnen* 141

Insect Cell Expression of Recombinant Imidazoleglycerolphosphate Dehydratase of Arabidopsis and Wheat and Inhibition by Triazole Herbicides. *Sachiyo Tada, Mika Hatano, Yumiko Nakayama, Sandra Volrath, David Guyer, Eric Ward, and Daisaku Ohta* 153

Urease Is Not Essential for Ureide Degradation in Soybean. *Norm E. Stebbins and Joseph C. Polacco* 169

Specific Binding of a Dichloroacetamide Herbicide Safener in Maize at a Site That Also Binds Thiocarbamate and Chloroacetanilide Herbicides. *Jonathan D. Walton and John E. Casida* 213

In Vivo Photomodification of Ribulose-1,5-Bisphosphate Carboxylase/Oxygenase Holoenzyme by Ultraviolet-B Radiation. Formation of a 66-Kilodalton Variant of the Large Subunit. *Michael I. Wilson, Sibdas Ghosh, Karen E. Gerhardt, Neta Holland, T. Sudhakar Babu, Marvin Edelman, Erwin B. Dumbroff, and Bruce M. Greenberg* 221

Adenosine 5′-Diphosphate-Glucose Pyrophosphorylase from Potato Tuber. Significance of the N Terminus of the Small Subunit for Catalytic Properties and Heat Stability. *Miguel A. Ballicora, Mary J. Laughlin, Yingbin Fu, Thomas W. Okita, Gerard F. Barry, and Jack Preiss* 245

*N*-Acylphosphatidylethanolamine in Dry and Imbibing Cottonseeds. Amounts, Molecular Species, and Enzymatic Synthesis. *John A. Sandoval, Zhi-Heng Huang, David C. Garrett, Douglas A. Gage, and Kent D. Chapman* 269

The Tonoplast $H^+$-ATPase of *Acer pseudoplatanus* Is a Vacuolar-Type ATPase That Operates with a Phosphoenzyme Intermediate. *Thierry Magnin, Annick Fraichard, Claudine Trossat, and Alain Pugin* 285

Glucosinolate Biosynthesis. Further Characterization of the Aldoxime-Forming Microsomal Monooxygenases in Oilseed Rape Leaves. *Richard N. Bennett, Alastair J. Hick, Glenn W. Dawson, and Roger M. Wallsgrove* 299

Microsomal *Lyso*-Phosphatidic Acid Acyltransferase from a *Brassica oleracea* Cultivar Incorporates Erucic Acid into the *sn*-2 Position of Seed Triacylglycerols. *David C. Taylor, Dennis L. Barton, E. Michael Giblin, Samuel L. MacKenzie, Cornelius G. J. van den Berg, and Peter B. E. McVetty* 409

Galactinol Synthase from Kidney Bean Cotyledon and Zucchini Leaf. Purification and N-Terminal Sequences. *Jingjie J. Liu, William Odegard, and Benito O. de Lumen* 505

Intracellular Carbonic Anhydrase of *Chlamydomonas reinhardtii*. *Jan Karlsson, Thomas Hiltonen, H. David Husic, Zakir Ramazanov, and Göran Samuelsson* 533

Molecular Cloning and Characterization of the cDNA Coding for the Biotin-Containing Subunit of the Chloroplastic Acetyl-Coenzyme A Carboxylase. *Joong-Kook Choi, Fei Yu, Eve Syrkin Wurtele, and Basil J. Nikolau* 619

Studies on the Processivity of Maize DNA Polymerase 2, an α-Type Enzyme. *Patricia Coello and Jorge M. Vázquez-Ramos* 645

Pseudoreversion Substitution at Large-Subunit Residue 54 Influences the $CO_2/O_2$ Specificity of Chloroplast Ribulose-Bisphosphate Carboxylase/Oxygenase. *Robert J. Spreitzer, Graham Thow, and Genhai Zhu* 681

Fatty Acid-Elongating Activity in Rapidly Expanding Leek Epidermis. *Kimberly J. Evenson and Dusty Post-Beittenmiller* 707

Identification and Characterization of a Phloem-Specific β-Amylase. *Qi Wang, Jonathan Monroe, and Richard D. Sjölund* 743

Expression of the *Hevea brasiliensis* (H.B.K.) Müll. Arg. 3-Hydroxy-3-Methylglutaryl-Coenzyme A Reductase 1 in Tobacco Results in Sterol Overproduction. *Hubert Schaller, Bernard Grausem, Pierre Benveniste, Mee-Len Chye, Chio-Tee Tan, Yu-Hua Song, and Nam-Hai Chua* 761

Formation of the Ferritin Iron Mineral Occurs in Plastids. An X-Ray Absorption Spectroscopy Study. *Geoffrey S. Waldo, Eric Wright, Zhi-Hai Whang, Jean-Francois Briat, Elizabeth C. Theil, and Dale E. Sayers* 797

A Specific Ascorbate Free Radical Reductase Isozyme Participates in the Regeneration of Ascorbate for Scavenging Toxic Oxygen Species in Potato Tuber Mitochondria. *Silvana De Leonardis, Giulia De Lorenzo, Giuseppe Borraccino, and Silvio Dipierro* 847

Molecular Cloning and Characterization of a Soluble Inorganic Pyrophosphatase in Potato. *Patrick du Jardin, Jorge Rojas-Beltran, Christiane Gebhardt, and Robert Brasseur* 853

Electron Transport Controls Glutamine Synthetase Activity in the Facultative Heterotrophic Cyanobacterium *Synechocystis* sp. PCC 6803. *José Carlos Reyes, José L. Crespo, Mario García-Domínguez, and Francisco Javier Florencio* 899

Isolation and Characterization of Biotin Carboxylase from Pea Chloroplasts. *Claude Alban, Jérôme Jullien, Dominique Job, and Roland Douce* 927

Evidence That Spinach Leaves Express Calreticulin but Not Calsequestrin. *Lorella Navazio, Barbara Baldan, Paola Dainese, Peter James, Ernesto Damiani, Alfredo Margreth, and Paola Mariani* 983

Metabolism of the Raffinose Family Oligosaccharides in Leaves of *Ajuga reptans* L. Inter- and Intracellular Compartmentation. *Markus Bachmann and Felix Keller* 991

Cloning of a Coconut Endosperm cDNA Encoding a 1-Acyl-*sn*-Glycerol-3-Phosphate Acyltransferase That Accepts Medium-Chain-Length Substrates. *Deborah S. Knutzon, Kathryn D. Lardizabal, Janet S. Nelsen, Janice L. Bleibaum, H. Maelor Davies, and James G. Metz* 999

Fractionation and Structural Characterization of Arabinogalactan-Proteins from the Cell Wall of Rose Cells. *Marcelo D. Serpe and Eugene A. Nothnagel* 1007

Quantitative Aspects of the in Vivo Regulation of Pyrophosphate:Fructose-6-Phosphate 1-Phosphotransferase by Fructose-2,6-Bisphosphate. *Tom Hamborg Nielsen and Bente Wischmann* 1033

Enzymes of Choline Synthesis in Spinach. Response of Phospho-Base *N*-Methyltransferase Activities to Light and Salinity. *Elizabeth A. Weretilnyk, David D. Smith, Gerhard A. Wilch, and Peter S. Summers* 1085

Purification and Partial Characterization of Tomato Extensin Peroxidase. *Michael Daniel Brownleader, Naziha Ahmed, Michael Trevan, Martin F. Chaplin, and Prakash M. Dey* 1115

Purification and Characterization of a Novel (*R*)-Mandelonitrile Lyase from the Fern *Phlebodium aureum*. *Harald Wajant, Siegfried Förster, Dirk Selmar, Franz Effenberger, and Klaus Pfizenmaier* 1231

Purification and Properties of *ent*-Kaurene Synthase B from Immature Seeds of Pumpkin. *Tamio Saito, Hiroshi Abe, Hisakazu Yamane, Akira Sakurai, Noboru Murofushi, Koji Takio, Nobutaka Takahashi, and Yuji Kamiya* 1239

Light-Harvesting Chlorophyll *a*/*b*-Binding Protein Inserted into Isolated Thylakoids Binds Pigments and Is Assembled into Trimeric Light-Harvesting Complex. *Andrea Kuttkat, Rudolf Grimm, and Harald Paulsen* 1267

Decarboxylation of Malate in the Crassulacean Acid Metabolism Plant *Bryophyllum* (*Kalanchoë*) *fedtschenkoi*. Role of NAD-Malic Enzyme. *Ritchard M. Cook, J. Gordon Lindsay, Malcolm B. Wilkins, and Hugh G. Nimmo* 1301

Examination of the Contribution of Vacuolar Proteases to Intracellular Protein Degradation in *Chara corallina*. *Yuji Moriyasu* 1309

Is the Reaction Catalyzed by 3-Hydroxy-3-Methylglutaryl Coenzyme A Reductase a Rate-Limiting Step for Isoprenoid Biosynthesis in Plants? *Joseph Chappell, Fred Wolf, Jeanne Proulx, Rick Cuellar, and Court Saunders* 1337

Molecular Dissection of the ϵ Subunit of the Chloroplast ATP Synthase of Spinach. *Jeffrey A. Cruz, Brian Harfe, Christopher A. Radkowski, Michael S. Dann, and Richard E. McCarty* 1379

Lysophosphatidic Acid Acyltransferase from Meadowfoam Mediates Insertion of Erucic Acid at the *sn*-2 Position of Triacylglycerol in Transgenic Rapeseed Oil. *Michael W. Lassner, Charlene K. Levering, H. Maelor Davies, and Deborah S. Knutzon* 1389

In Situ Glutamine Synthetase Activity in a Marine Unicellular Alga. Development of a Sensitive Colorimetric Assay and the Effects of Nitrogen Status on Enzyme Activity. *T. Alwyn V. Rees, Tony R. Larson, Jos W. G. Heldens, and Frank G. J. Huning* 1405

Oxidation of Imported or Endogenous Carbohydrates by Isolated Chloroplasts from Green Pepper Fruits. *Erwin Thom and H. Ekkehard Neuhaus* 1421

Subsaturating Ribulose-1,5-Bisphosphate Concentration Promotes Inactivation of Ribulose-1,5-Bisphosphate Carboxylase/Oxygenase (Rubisco). Studies Using Continuous Substrate Addition in the Presence and Absence of Rubisco Activase. *Archie R. Portis, Jr., Ross McC. Lilley, and T. John Andrews* 1441

Suborganellar Localization and Molecular Characterization of Nonproteolytic Degraded Leukoplast Pyruvate Kinase from Developing Castor Oil Seeds. *Fayek B. Negm, Fiona A. Cornel, and William C. Plaxton* 1461

Differential Induction of Cytochrome P450-Mediated Triasulfuron Metabolism by Naphthalic Anhydride and Triasulfuron. *Michael W. Persans and Mary A. Schuler* 1483

**WHOLE PLANT, ENVIRONMENTAL, AND STRESS PHYSIOLOGY**

Cold Acclimation of *Arabidopsis thaliana*. Effect on Plasma Membrane Lipid Composition and Freeze-Induced Lesions. *Matsuo Uemura, Raymond A. Joseph, and Peter L. Steponkus* 15

Membrane Potential Depolarization of Root Cap Cells Precedes Aluminum Tolerance in Snapbean. *Gary Paul Olivetti, Jonathan Reast Cumming, and Bud Etherton* 123

1-Chloro-2,4-Dinitrobenzene-Elicited Increase in Vacuolar Glutathione-*S*-Conjugate Transport Activity. *Ze-Sheng Li, Rui-Guang Zhen, and Philip A. Rea* 177

Properties of Proton Pumping in Response to Blue Light and Fusicoccin in Guard Cell Protoplasts Isolated from Adaxial Epidermis of *Vicia* Leaves. *Chang-Hyo Goh, Tatsuo Oku, and Ken-ichiro Shimazaki* 187

Retention of Cadmium in Roots of Maize Seedlings. Role of Complexation by Phytochelatins and Related Thiol Peptides. *Wilfried E. Rauser and Philippe Meuwly* 195

Differential Accumulation of Antioxidant mRNAs in *Arabidopsis thaliana* Exposed to Ozone. *Patricia L. Conklin and Robert L. Last* 203

Regulation of Photosynthetic Induction State in High- and Low-Light-Grown Soybean and *Alocasia macrorrhiza* (L.) G. Don. *John P. Krall, Elena V. Sheveleva, and Robert W. Pearcy* 307

Kinetics of $NO_3^-$ Influx in Spruce. *Herbert J. Kronzucker, M. Yaeesh Siddiqi, and Anthony D. M. Glass* 319

Amelioration of Ozone-Induced Oxidative Damage in Wheat Plants Grown under High Carbon Dioxide. Role of Antioxidant Enzymes. *Mulpuri V. Rao, Beverly A. Hale, and Douglas P. Ormrod* 421

Identification and Gene Expression of Anaerobically Induced Enolase in *Echinochloa phyllopogon* and *Echinochloa crus-pavonis*. *Theodore C. Fox, Cesar V. Mujer, David L. Andrews, Adrienne S. Williams, B. Greg Cobb, Robert A. Kennedy, and Mary E. Rumpho* 433

Analysis of $^{13}NH_4^+$ Efflux in Spruce Roots. A Test Case for Phase Identification in Compartmental Analysis. *Herbert J. Kronzucker, M. Yaeesh Siddiqi, and Anthony D. M. Glass* 481

A Putative Vacuolar Processing Protease Is Regulated by Ethylene and also during Fruit Ripening in *Citrus* Fruit. *Jose Miguel Alonso and Antonio Granell* 541

Tonoplast $Na^+/H^+$ Antiport Activity and Its Energization by the Vacuolar $H^+$-ATPase in the Halophytic Plant *Mesembryanthemum crystallinum* L. *Bronwyn J. Barkla, Luisa Zingarelli, Eduardo Blumwald, and J. Andrew C. Smith* 549

Onset of Phloem Export from Senescent Petals of Daylily. *Roderick L. Bieleski* 557

Sucrose Release into the Endosperm Cavity of Wheat Grains Apparently Occurs by Facilitated Diffusion across the Nucellar Cell Membranes. *Ning Wang and Donald B. Fisher* 579

Sucrose Concentration Gradients along the Post-Phloem Transport Pathway in the Maternal Tissues of Developing Wheat Grains. *Donald B. Fisher and Ning Wang* 587

Translatable RNA Populations Associated with Maintenance of Primary Root Elongation and Inhibition of Mesocotyl Elongation by Abscisic Acid in Maize Seedlings at Low Water Potentials. *Imad N. Saab, T.-H. David Ho, and Robert E. Sharp* 593

A Rapeseed Cold-Inducible Transcript Encodes a Phospho*enol*pyruvate Carboxykinase. *Julio Sáez-Vásquez, Monique Raynal, and Michel Delseny* 611

Effect of High Temperature on Plant Growth and Carbohydrate Metabolism in Potato. *Abbas M. Lafta and James H. Lorenzen* 637

Chill-Induced Changes in the Activity and Abundance of the Vacuolar Proton-Pumping Pyrophosphatase from Mung Bean Hypocotyls. *Catherine P. Darley, Julia M. Davies, and Dale Sanders* 659

Rheological Properties of Enzymatically Isolated Tomato Fruit Cuticle. *Peter D. Petracek and Martin J. Bukovac* 675

Cold Hardening of Spring and Winter Wheat and Rape Results in Differential Effects on Growth, Carbon Metabolism, and Carbohydrate Content. *Vaughan M. Hurry, Åsa Strand, Marie Tobiæson, Per Gardeström, and Gunnar Öquist* 697

How Do Stomata Read Abscisic Acid Signals? *Carlos L. Trejo, Alison L. Clephan, and William J. Davies* 803

Temperature Affects Expansion Rate of Maize Leaves without Change in Spatial Distribution of Cell Length. Analysis of the Coordination between Cell Division and Cell Expansion. *Halim Ben-Haj-Salah and François Tardieu* 861

Copper-Sensitive Mutant of *Arabidopsis thaliana*. *Catherine van Vliet, Chris R. Andersen, and Christopher S. Cobbett* 871

Antifreeze Proteins in Winter Rye Are Similar to Pathogenesis-Related Proteins. *Wai-Ching Hon, Marilyn Griffith, Andrzej Mlynarz, Yan C. Kwok, and Daniel S. C. Yang* 879

Ozone-Induced Ethylene Emission Accelerates the Loss of Ribulose-1,5-Bisphosphate Carboxylase/Oxygenase and Nuclear-Encoded mRNAs in Senescing Potato Leaves. *Richard E. Glick, Carl D. Schlagnhaufer, Richard N. Arteca, and Eva J. Pell* 891

Aging of Dry Desiccation-Tolerant Pollen Does Not Affect Protein Secondary Structure. *Willem F. Wolkers and Folkert A. Hoekstra* 907

Comparison of Metallothionein Gene Expression and Nonprotein Thiols in Ten Arabidopsis Ecotypes. Correlation with Copper Tolerance. *Angus Murphy and Lincoln Taiz* 945

Reversible Photoinhibition in Antarctic Moss during Freezing and Thawing. *Catherine E. Lovelock, Anne E. Jackson, David R. Melick, and Rodney D. Seppelt* 955

Effects of Iron Limitation on Photosystem II Composition and Light Utilization in *Dunaliella tertiolecta*. *Ilya R. Vassiliev, Zbigniew Kolber, Kevin D. Wyman, David Mauzerall, Vipula K. Shukla, and Paul G. Falkowski* 963

A Negative Hydraulic Message from Oxygen-Deficient Roots of Tomato Plants? Influence of Soil Flooding on Leaf Water Potential, Leaf Expansion, and Synchrony between Stomatal Conductance and Root Hydraulic Conductivity. *Mark A. Else, William J. Davies, Michael Malone, and Michael B. Jackson* 1017

Overexpression of Glutathione Reductase but Not Glutathione Synthetase Leads to Increases in Antioxidant Capacity and Resistance to Photoinhibition in Poplar Trees. *Christine H. Foyer, Nadège Souriau, Sophie Perret, Maud Lelandais, Karl-Josef Kunert, Christophe Pruvost, and Lise Jouanin* 1047

Amylolytic Activities in Cereal Seeds under Aerobic and Anaerobic Conditions. *Lorenzo Guglielminetti, Junji Yamaguchi, Pierdomenico Perata, and Amedeo Alpi* 1069

Arabidopsis Mutants Lacking Phenolic Sunscreens Exhibit Enhanced Ultraviolet-B Injury and Oxidative Damage. *Laurie G. Landry, Clint C. S. Chapple, and Robert L. Last* 1159

The Role of Ethylene in Interorgan Signaling during Flower Senescence. *Ernst J. Woltering, Dianne Somhorst, and Pieter van der Veer* 1219

Effect of Volatile Methyl Jasmonate on the Oxylipin Pathway in Tobacco, Cucumber, and Arabidopsis. *Sergei Avdiushko, Kevan P. C. Croft, Grayson C. Brown, D. Mike Jackson, Tom R. Hamilton-Kemp, and David Hildebrand* 1227

Changes in Isozyme Profiles of Catalase, Peroxidase, and Glutathione Reductase during Acclimation to Chilling in Mesocotyls of Maize Seedlings. *Marc D. Anderson, Tottempudi K. Prasad, and Cecil R. Stewart* 1247

Plasma Membrane Sterols Are Essential for Sensing Osmotic Changes in the Halotolerant Alga *Dunaliella*. *Adrian M. Zelazny, Aviv Shaish, and Uri Pick* 1395

Mechanisms of Cadmium Mobility and Accumulation in Indian Mustard. *David E. Salt, Roger C. Prince, Ingrid J. Pickering, and Ilya Raskin* 1427

Apoplastic pH and Ammonium Concentration in Leaves of *Brassica napus* L. *Søren Husted and Jan Kofod Schjoerring* 1453

A Calorimetric Study of the Glass Transition Behaviors in Axes of Bean Seeds with Relevance to Storage Stability. *Olivier Leprince and Christina Walters-Vertucci* 1471

**DEVELOPMENT AND GROWTH REGULATION**

Increased Putrescine Biosynthesis through Transfer of Mouse Ornithine Decarboxylase cDNA in Carrot Promotes Somatic Embryogenesis. *Dhundy R. Bastola and Subhash C. Minocha* 63

Continuous Far-Red Light Activates Plastid DNA Synthesis in Pea Leaves but Not Full Cell Enlargement or an Increase in Plastid Number per Cell. *Arnold N. DuBell and John E. Mullet* 95

Correlated Changes in the Activity, Amount of Protein, and Abundance of Transcript of NADPH:Protochlorophyllide Oxidoreductase and Chlorophyll Accumulation during Greening of Cucumber Cotyledons. *Kazuichi Yoshida, Ru-Min Chen, Ayumi Tanaka, Haruhiko Teramoto, Ryonichi Tanaka, Michael P. Timko, and Hideo Tsuji* 231

Cloning and Characterization of a Glutathione *S*-Transferase That Can Be Photolabeled with 5-Azido-indole-3-acetic Acid. *Jürg Bilang and Arnd Sturm* 253

Changes in Protein Isoprenylation during the Growth of Suspension-Cultured Tobacco Cells. *Teresa A. Morehead, Brenda J. Biermann, Dring N. Crowell, and Stephen K. Randall* 277

The Biochemical Response of Electrical Signaling in the Reproductive System of *Hibiscus* Plants. *Jörg Fromm, Mohammad Hajirezaei, and Ingo Wilke* 375

Molecular and Ultrastructural Analysis of a Nonchromosomal Variegated Mutant. Tomato Mitochondrial Mutants That Cause Abnormal Leaf Development. *Augusta B. Bonnema, Catherine Castillo, Nathan Reiter, Mark Cunningham, Henry P. Adams, and Mary O'Connell* 385

Differential Expression of Proteins and mRNAs from Border Cells and Root Tips of Pea. *Lindy A. Brigham, Ho-Hyung Woo, S. Monique Nicoll, and Martha C. Hawes* 457

β-Tubulin Accumulation and DNA Replication in Imbibing Tomato Seeds. *Renato D. de Castro, Xiaoying Zheng, Jan H. W. Bergervoet, C. H. Ric De Vos, and Raoul J. Bino* 499

Identification of an *N*-Glucoside of *cis*-Zeatin from Potato Tuber Sprouts. *Björn Nicander, Per-Olof Björkman, and Elisabeth Tillberg* 513

Light Alters Cytosolic and Plastidic Phosphorylase Distribution in Pearl Millet Leaves. *Kommineni J. Maragatha Vally, Manickam T. Selvi, and Rameshwar Sharma* 517

Class I β-1,3-Glucanases in the Endosperm of Tobacco during Germination. *Gerhard Leubner-Metzger, Corinne Fründt, Regina Vögeli-Lange, and Frederick Meins, Jr.* 751

A New 1-Aminocyclopropane-1-Carboxylic Acid-Conjugating Activity in Tomato Fruit. *Melinda Neal Martin, Jerry D. Cohen, and Robert A. Saftner* 917

Expression of Functional Oat Phytochrome A in Transgenic Rice. *Richard C. Clough, Jorge J. Casal, Emily T. Jordan, Paul Christou, and Richard D. Vierstra* 1039

Altered Growth and Wood Characteristics in Transgenic Hybrid Aspen Expressing *Agrobacterium tumefaciens* T-DNA Indoleacetic Acid-Biosynthetic Genes. *Hannele Tuominen, Folke Sitbon, Charlotta Jacobsson, Göran Sandberg, Olof Olsson, and Björn Sundberg* 1179

Seed and 4-Chloroindole-3-Acetic Acid Regulation of Gibberellin Metabolism in Pea Pericarp. *Rika van Huizen, Jocelyn A. Ozga, Dennis M. Reinecke, Bruce Twitchin, and Lewis N. Mander* 1213

Sucrose Synthase Localization during Initiation of Seed Development and Trichome Differentiation in Cotton Ovules. *Kurt D. Nolte, Donald L. Hendrix, John W. Radin, and Karen E. Koch* 1285

Increased 1-Aminocyclopropane-1-Carboxylic Acid Oxidase Activity in Shoots of Flooded Tomato Plants Raises Ethylene Production to Physiologically Active Levels. *Philippa J. English, Grantley W. Lycett, Jeremy A. Roberts, and Michael B. Jackson* 1435

**GENE REGULATION AND MOLECULAR GENETICS**

Temporal and Spatial Expression of Amygdalin Hydrolase and (*R*)-(+)-Mandelonitrile Lyase in Black Cherry Seeds. *Liansheng Zheng and Jonathan E. Poulton* 31

Stress Activation of a Bean Hydroxyproline-Rich Glycoprotein Promoter Is Superimposed on a Pattern of Tissue-Specific Developmental Expression. *Keith L. Wycoff, Patricia A. Powell, Robert A. Gonzales, David R. Corbin, Chris Lamb, and Richard A. Dixon* 41

Function of Phytochrome A in Potato Plants as Revealed through the Study of Transgenic Plants. *Arnd G. Heyer, David Mozley, Volker Landschütze, Brian Thomas, and Christiane Gatz* 53

Transgenic Analysis of a Hybrid Poplar Wound-Inducible Promoter Reveals Developmental Patterns of Expression Similar to That of Storage Protein Genes. *Jay B. Hollick and Milton P. Gordon* 73

Differential Transcription of Pea Chloroplast Genes during Light-Induced Leaf Development. Continuous Far-Red Light Activates Chloroplast Transcription. *Arnold N. DuBell and John E. Mullet* 105

Light-Dependent and Tissue-Specific Expression of the H-Protein of the Glycine Decarboxylase Complex. *R. Srinivasan and David J. Oliver* 161

The *diageotropica* Mutation and Synthetic Auxins Differentially Affect the Expression of Auxin-Regulated Genes in Tomato. *Nobuaki Mito and Alan B. Bennett* 293

Characterization and Gene Expression of Nodulin Npv30 from Common Bean. *Francisco Campos, Carolina Carsolio, Hilda Kuin, Ton Bisseling, Mario Rocha-Sosa, and Federico Sánchez* 363

Histones of *Chlamydomonas reinhardtii*. Synthesis, Acetylation, and Methylation. *Jakob Harm Waterborg, Anthony James Robertson, Dalida Laura Tatar, Corina Marilena Borza, and James Ronald Davie* 393

Blue-Light-Regulated Expression of Genes for Two Early Steps of Chlorophyll Biosynthesis in *Chlamydomonas reinhardtii*. *Gail L. Matters and Samuel I. Beale* 471

Polyphenol Oxidase in Potato. A Multigene Family That Exhibits Differential Expression Patterns. *Peter W. Thygesen, Ian B. Dry, and Simon P. Robinson* 525

*COI1*-Dependent Expression of an Arabidopsis Vegetative Storage Protein in Flowers and Siliques and in Response to Coronatine or Methyl Jasmonate. *Celso Eduardo Benedetti, Daoxin Xie, and John Gordon Turner* 567

Identification and Characterization of cDNAs Encoding Ethylene Biosynthetic Enzymes from *Pelargonium* × *hortorum* cv Snow Mass Leaves. *Tzann-Wei Wang and Richard N. Arteca* 627

The Bean Seed Storage Protein β-Phaseolin Is Synthesized, Processed, and Accumulated in the Vacuolar Type-II Protein Bodies of Transgenic Rice Endosperm. *Zhenwei Zheng, Kazuhiko Sumi, Kunisuke Tanaka, and Norimoto Murai* 777

Redox Regulation of Light-Harvesting Complex II and *cab* mRNA Abundance in *Dunaliella salina*. *Denis P. Maxwell, David E. Laudenbach, and Norman P. A. Huner* 787

An *Arabidopsis thaliana* Thionin Gene Is Inducible via a Signal Transduction Pathway Different from That for Pathogenesis-Related Proteins. *Petra Epple, Klaus Apel, and Holger Bohlmann* 813

The Regulation of Carbonic Anhydrase and Ribulose-1,5-Bisphosphate Carboxylase/Oxygenase Activase by Light and $CO_2$ in *Chlamydomonas reinhardtii*. *Mamta Rawat and James V. Moroney* 937

Cell Ablation Reveals That Expression from the Phaseolin Promoter Is Confined to Embryogenesis and Microsporogenesis. *Apolonia H. M. van der Geest, David A. Frisch, John D. Kemp, and Timothy C. Hall* 1151

Induction of Nopaline Synthase Promoter Activity by $H_2O_2$ Has No Direct Correlation with Salicylic Acid. *Ziyu Dai and Gynheung An* 1191

Stable Accumulation of *Aspergillus niger* Phytase in Transgenic Tobacco Leaves. *Theo C. Verwoerd, Peter A. van Paridon, Albert J. J. van Ooyen, Jan W. M. van Lent, André Hoekema, and Jan Pen* 1199

Molecular Characterization of the Plastidic Glucose-6-Phosphate Dehydrogenase from Potato in Comparison to Its Cytosolic Counterpart. *Antje von Schaewen, Georg Langenkämper, Kerstin Graeve, Irina Wenderoth, and Renate Scheibe* 1327

Structural Requirements of Oleosin Domains for Subcellular Targeting to the Oil Body. *Gijs J. H. van Rooijen and Maurice M. Moloney* 1353

Isolation of a Polyubiquitin Promoter and Its Expression in Transgenic Potato Plants. *Joan E. Garbarino, Teruko Oosumi, and William R. Belknap* 1371

**CELL BIOLOGY AND SIGNAL TRANSDUCTION**

Alternative Oxidase Activity in Tobacco Leaf Mitochondria. Dependence on Tricarboxylic Acid Cycle-Mediated Redox Regulation and Pyruvate Activation. *Greg C. Vanlerberghe, David A. Day, Joseph T. Wiskich, Alison E. Vanlerberghe, and Lee McIntosh* 353

Induction of Stomatal Closure by Vanadate or a Light/Dark Transition Involves $Ca^{2+}$ Calmodulin-Dependent Protein Phosphorylations. *Alain Cousson, Valérie Cotelle, and Alain Vavasseur* 491

Auxin-Modulated Protein Disulfide-Thiol-Interchange Activity from Soybean Plasma Membranes. *D. James Morré, Rafael de Cabo, Elizabeth Jacobs, and Dorothy M. Morré* 573

Targeting and Release of Phytohemagglutinin from the Roots of Bean Seedlings. *Susanne Kjemtrup, Olga Borkhsenious, Natasha V. Raikhel, and Maarten J. Chrispeels* 603

Anion-Channel Blockers Inhibit S-Type Anion Channels and Abscisic Acid Responses in Guard Cells. *Amnon Schwartz, Nitza Ilan, Martin Schwarz, Jennifer Scheaffer, Sarah M. Assmann, and Julian I. Schroeder* 651

Multiple Isoforms of Arabidopsis Casein Kinase I Combine Conserved Catalytic Domains with Variable Carboxyl-Terminal Extensions. *Leszek J. Klimczak, Donatella Farini, Chentao Lin, Donatella Ponti, Anthony R. Cashmore, and Giovanni Giuliano* 687

Arginine Decarboxylase Is Localized in Chloroplasts. *Antonio Borrell, Francisco A. Culiañez-Macià, Teresa Altabella, Robert T. Besford, Dante Flores, and Antonio F. Tiburcio* 771

Sugar-Induced Increase of Calcium-Dependent Protein Kinases Associated with the Plasma Membrane in Leaf Tissues of Tobacco. *Masa-aki Ohto and Kenzo Nakamura* 973

Involvement of Free Calcium in Action of Cryptogein, a Proteinaceous Elicitor of Hypersensitive Reaction in Tobacco Cells. *Eric Tavernier, David Wendehenne, Jean-Pierre Blein, and Alain Pugin* 1025

Actin Filaments in Mature Guard Cells Are Radially Distributed and Involved in Stomatal Movement. *MoonJeong Kim, Peter K. Hepler, Soon-Ok Eun, Kwon Soo Ha, and Youngsook Lee* 1077

Multiple Genes, Tissue Specificity, and Expression-Dependent Modulation Contribute to the Functional Diversity of Potassium Channels in *Arabidopsis thaliana*. *Yongwei Cao, John M. Ward, Walter B. Kelly, Audrey M. Ichida, Richard F. Gaber, Julie A. Anderson, Nobuyuki Uozumi, Julian I. Schroeder, and Nigel M. Crawford* 1093

Evidence for a Mechanically Induced Oxidative Burst. *Tami Yahraus, Sreeganga Chandra, Laurent Legendre, and Philip S. Low* 1259

Temperature and Abscisic Acid Can Be Used to Regulate Survival, Growth, and Differentiation of Cultured Guard Cell Protoplasts of Tree Tobacco. *Cathy Roberts, Prateek Sahgal, Frank Merritt, Bryan Perlman, and Gary Tallman* 1411

**BIOENERGETICS**

Electron Partitioning between the Cytochrome and Alternative Pathways in Plant Mitochondria. *Miquel Ribas-Carbo, Joseph A. Berry, Dan Yakir, Larry Giles, Sharon A. Robinson, Adrian M. Lennon, and James N. Siedow* 829

Decreased Photosystem II Core Phosphorylation in a Yellow-Green Mutant of Wheat Showing Monophasic Fluorescence Induction Curve. *Maria T. Giardi, Tomas Kucera, Jean-Marie Briantais, and Michael Hodges* 1059

The Function of Ascorbic Acid in Photosynthetic Phosphorylation. *Giorgio Forti and Gianluca Elli* 1207

Plasma Membrane $H^+$-ATPase in Maize Roots Induced for $NO_3^-$ Uptake. *Simonetta Santi, Geraldine Locci, Roberto Pinton, Stefano Cesco, and Zeno Varanini* 1277

Inorganic Carbon-Stimulated $O_2$ Photoreduction Is Suppressed by $NO_2^-$ Assimilation in Air-Grown Cells of *Synechococcus* UTEX 625. *Nazir Ahmad Mir, Christophe Salon, and David Thomas Canvin* 1295

Electrochemical Potential Gradients of $H^+$, $K^+$, $Ca^{2+}$, and $Cl^-$ across the Tonoplast of the Green Alga *Eremosphaera viridis*. *Birgit Bethmann, Manfred Thaler, Wilhelm Simonis, and Gerald Schönknecht* 1317

Factors Affecting Development of Peroxisomes and Glycolate Metabolism among Algae of Different Evolutionary Lines of the Prasinophyceae. *Petra Kehlenbeck, Arun Goyal, and N. Edward Tolbert* 1363

**PLANT-MICROBE AND PLANT-INSECT INTERACTIONS**

Morphological and Molecular Characteristics of Host-Conditioned Ineffective Root Nodules in Cowpea. *Daniel Purdom and Arthur T. Trese* 239

Ferric Leghemoglobin in Plant-Attached Leguminous Nodules. *Keuk-ki Lee, Linda L. Shearman, B. Kipp Erickson, and Robert V. Klucas* 261

A Potent Antimicrobial Protein from Onion Seeds Showing Sequence Homology to Plant Lipid Transfer Proteins. *Bruno Philippe Angelo Cammue, Karin Thevissen, Marijke Hendriks, Kristel Eggermont, Inge Johanna Goderis, Paul Proost, Jozef Van Damme, Rupert William Osborn, Françoise Guerbette, Jean-Claude Kader, and Willem Frans Broekaert* 445

Levels of a Terpenoid Glycoside (Blumenin) and Cell Wall-Bound Phenolics in Some Cereal Mycorrhizas. *Walter Maier, Heinrich Peipp, Jürgen Schmidt, Victor Wray, and Dieter Strack* 465

Inhibition of *Diabrotica* Larval Growth by Patatin, the Lipid Acyl Hydrolase from Potato Tubers. *James A. Strickland, Gregory L. Orr, and Terence A. Walsh* 667

Induced Responses in Phenolic Metabolism in Two Norway Spruce Clones after Wounding and Inoculations with *Ophiostoma polonicum*, a Bark Beetle-Associated Fungus. *Franck Brignolas, Benoit Lacroix, François Lieutier, Daniel Sauvard, Alain Drouet, Anne-Catherine Claudot, Annie Yart, Alan A. Berryman, and Erik Christiansen* 821

A Structural Model for the Mechanisms of Elicitor Release from Fungal Cell Walls by Plant β-1,3-Endoglucanase. *Yasushi Okinaka, Kaoru Mimori, Kenichi Takeo, Shinichi Kitamura, Yoji Takeuchi, Naoto Yamaoka, and Masaaki Yoshikawa* 839

Local and Systemic Biosynthesis of Salicylic Acid in Infected Cucumber Plants. *Philippe Meuwly, Wolfgang Mölders, Antony Buchala, and Jean-Pierre Métraux* 1107

Sugar-Binding Activity of Pea Lectin Expressed in White Clover Hairy Roots. *Clara L. Díaz, Trudy J. J. Logman, Hanneke C. Stam, and Jan W. Kijne* 1167

*Lupinus albus* L. Pathogenesis-Related Proteins That Show Similarity to PR-10 Proteins. *M. Paula Pinto and Cândido P. P. Ricardo* 1345

**THE ELECTRONIC PLANT GENE REGISTER** 337, 721, 1125, 1497

**CORRECTION**

Bean α-Amylase Inhibitor Confers Resistance to the Pea Weevil (*Bruchus pisorum*) in Transgenic Peas (*Pisum sativum* L.). *Hartmut E. Schroeder, Stephanie Gollasch, Andrew Moore, Linda M. Tabe, Stuart Craig, Darryl C. Hardie, Maarten J. Chrispeels, Donald Spencer, and Thomas J. V. Higgins* 1129